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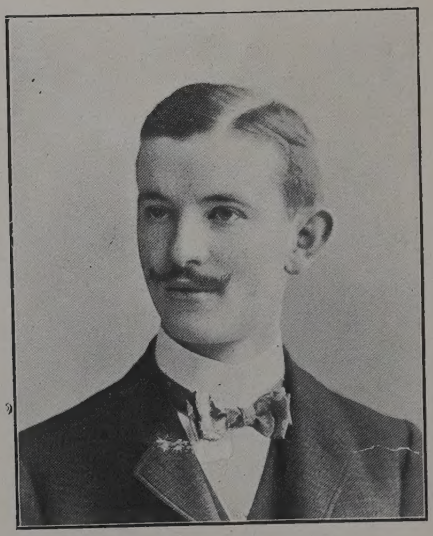

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A. P. MORGAN.

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Pileus white, convex, sulcate, umbilicate, depressed around the umbo. Stipe slender, elongated, glabrous, tawny, insititious. Lamellae few, white, rather broad, collariate.

Growing on dead leaves. Pileus 2 mm. in diameter, the stipe 2-3 cm. in length.

125. MARASMIUS GRAMINUM B. & BR. BERKLEY'S OUTLINES. 1860. *Agaricus graminum* Libert, Pl. Crypt. 1837.

Pileus membranaceous, convex then plane, umbonate, sulcate, very pale rufous. Stipe capillary, glabrous, shining, black, pale at the apex. Lamellae adnate to a free collar, equal, few and very distant (6-8), whitish; spores ovoid, 5-6 mic.

Growing on withered leaves of grasses. Pileus 4-6 mm. in diameter, the stipe 2-5 cm. long.

126. MARASMIUS CURREYI B. &. BR. ANN. & MAG. N. H.

Pileus nearly plane, sulcate, pale rufous, the grooves paler, the umbo tawny. Stipe quite smooth, shining, black, white at the apex. Lamellae few, cream-colored, attached to a collar round the stipe; spores ovoid-oblong, 9-11 x 5-6 mic.

Growing on leaves of grass. Pileus 6-10 mm. in diameter, the stipe 2-3 cm. long.

B. STIPE VELVETY OR PRUINATE.

a. Pileus Colored.

127. MARASMIUS ATRO-RUBENS Berk. Journ. Bot. 1842.

Pileus membranaceous, convex, regularly radiate-venose, dark reddish. Stipe very slender, umber, velvety. Lamellae rather close, cultrate, pallid.

Growing on old leaves and dead trunks in woods. Pileus 9-10 mm. in diameter.

128. MARASMIUS THUJINUS Peck, N. Y. Rep. 1902.

Pileus membranaceous, hemispheric or convex, often slightly umbilicate, minutely pulverulent-tomentose, distantly striate on the margin, cinereous tinged with lilac. Stipe capillary, glabrous or with a few minute scattered flocci, pallid, sometimes brownish toward the base. Lamellae few, distant, adnate, white.

Growing on fallen leaves of Thuja. Pileus 2-3 mm. in diameter, the stipe 1-2 cm. long, scarcely thicker than a hair.

129. MARASMIUS FELIX Morgan, sp. nov.

Pileus membranaceous, convex then explanate, glabrous, faintly plicate-rugulose, rufescent. Stipe more or less elongated, capillary, minutely pubescent, brown or blackish, white at the apex, the base insititious. Lamellae unequal, some of them forked, rather narrow, distant, adnate, white; spores ovoid-oblong, apiculate, 7-9 x 3-4 mic.

Growing on old leaves of Platanus, insititious on the petioles and veins. Preston, O. Pileus 2-6 mm. in diameter, the stipe varying in length from 2-8 cm. Pileus pale rufous or nearly white to testaceous, becoming more saturated with the color in drying. A near relative of *M. epiphyllus.* Pers.

b. Pileus white or whitish.

a'. Pileus Plicate — Sulcate.

130. MARASMIUS INSITITIOUS Fries. Hym. Eur.

Pileus membranaceous, tough, convexo-plane, subumbilicate, at length plicate-sulcate and whitish. Stipe horny, fistulous, floccose-furfuraceous, reddish-brown, tapering downward to the simple, insititious base. Lamellae broadly adnate, unequal, simple, distant, becoming white; spores elliptic-ovoid, 4 x 2.5 mic.

Growing on fallen leaves of oak, etc. Pileus 5-10 mm. in diameter, the stipe 2-3 cm. in length.

131. MARASMIUS SACCHARINUS Fries. Hym. Eur. *Agaricus saccharinus* Batsch El. Fung. 1784.

Pileus membranaceous, convex, somewhat papillate, glabrous, sulcate and plicate, white. Stipe very slender, flocculose, glabrate, obliquely insititious, reddish. Lamellae broadly adnate, narrow, thick, very distant, reticulate-conjoined, whitish; spores elliptic, 5 x 3 mic.

Growing on leaves, twigs, etc. Pileus 2-4 mm. in diameter, the stipe 1.5-2.5 cm. long.

b'. Pileus Even or Only Rugulose.

132. MARASMIUS PERFORANS Fries. Hym. Eur. *Agaricus perforans* Hoffman, Nom. Fung. 1789.

Ill-smelling. Pileus submembranaceous, rather plane, without striae, rugulose, glabrous, whitish. Stipe fistulous, equal, velvety, bay-black, the base insititious. Lamellae adnate, simple, rather close, whitish, most of them dimidiate; spores elliptic-ovoid, 5-6 x 2-3 mic.

Growing on leaves of Abies. Pileus 6-10 mm. in diameter, the stipe 2-4 cm. long.

133. MARASMIUS EPIPHYLLUS Fries. Hym. Eur. *Agaricus epiphyllus* Persoon, Synopsis. 1801.

Pileus membranaceous, rather plane, at length umbilicate, glabrous, plicate-rugose, milk-white. Stipe horny, fistulous, slightly velvety, brown below, insititious. Lamellae adnate, few and distant, entire venose, white; spores oblong, 6-7 x 2 mic.

Growing on the petioles and veins of old leaves. Pileus 5-10 mm. in diameter, the stipe 3-5 cm. long.

134. MARASMIUS MINUTISSIMUS Peck, 27 N. Y. Rep. 1874.

Very small, the whole surface invested with a minute glandular pubescence. Pileus membranaceous, convex then explanate, faintly rugulose, whitish. Stipe filiform, brown below, fading gradually to white at the apex, the base insititious. Lamellae few and distant (4-10), white, narrow, adnate, sometimes vein-like and imperfect; spores lance-oblong, 7-10 x 3-4 mic.

Growing on old leaves along the borders of fields next to woods. Pileus 2-5 mm. in diameter, the stipe 6-16 mm. long. The glandular hairs are longest on the lower part of the stipe, becoming smaller upward and on the pileus and most minute on the lamellae. Peck's description is of the smallest plants.

§2. *OMPHALIA. PILEUS SUBMEMBRANACEOUS; THE STIPE CENTRAL, CARTILAGINOUS, FISTULOSE, SOMEWHAT THICKENED UPWARD; THE LAMELLAE TRULY DECURRENT.*

I. CYATHIFORMES. *Pileus submembranaceous, at length depressed, umbilicate or even infundibuliform.*

A. STIPE GLABROUS.

135. MARASMIUS VAILLANTII Fries, Hym. Eur. *Fungus pileo candicante, etc.* Vaillant, Bot. Paris, 1727. *Agaricus Vaillantii* Persoon Synopsis. 1801.

Pileus submembranaceous, tough, soon explanate, depressed, plicate-rugose, whitish. Stipe stuffed, glabrous, brown, the apex thickened and paler. Lamellae broad, subdecurrent, thick, distant, white; spores elliptic, 10x6 mic.

Growing on old wood, fallen twigs, leaves, etc. Pileus 1-2 cm. in diameter, the stipe about 2.5 cm. long.

136. MARASMIUS LANGUIDUS Fries Hym. Eur. *Agaricus languidus* Lasch. Linnaea, No. 157.

Pileus a little fleshy, convex, gibbous or umbilicate, flocculose, rugose-sulcate, yellowish and flesh-color, becoming whitish. Stipe stuffed, thickened above, naked and pallid, below brown or blackish and sometimes villose thickened at the base. Lamellae adnate becoming decurrent, distant, narrow, venose-connected; spores 6-7x4 mic.

Growing on twigs, herbaceous stems, etc. Pileus 10-15 mm. in diameter, the stipe about 2.5 cm. long.

137. MARASMIUS HYPERELLUS Fries, Nov. Symb. 1857.

Pileus very thin, membranaceous, explanate, umbilicate, lineate-triate, rugulose when dry, whitish. Stipe filiform, fistulose, glabrous, brown or blackish, encircled by an orbicular base. Lamellae subdecurrent, distant, thin, whitish.

Growing on sticks. Pileus 10-12 mm. in diameter, the stipe 3.5-4 cm. long.

138. MARASMIUS VIRIDI-FUSCUS B. & C. Fungi Cub. 103.

Pileus thin, explanate, radiate-striate, pale green. Stipe slender, glabrous, thickened upward, brown or blackish below. Lamellae broad, distant, decurrent, green.

Growing on dead sticks. Pileus 10-12 mm. in diameter, the stipe 12 mm. long.

139. MARASMIUS CYATHIFORMIS B. & C. Fungi Cub. 104.

Caespitose. Pileus cyathiform, glabrous, brown when dry. Stipe dilated upward. Lamellae distant, decurrent.

Growing on dead wood. Pileus 2-2.5 cm. in diameter, the stipe 2-3 cm. long and 1 mm. thick.

140. MARASMIUS PURPURASCENS B. & C. Fungi Cub. 105.

Pileus thin, infundibuliform, minutely tomentose, striatulate, pale purple, when dry whitish. Stipe glabrous, concolorous. Lamellae close, narrow, decurrent, concolorous.

Growing on sticks in shady woods. Pileus 2 cm. in diameter, the stipe 2-3 cm. long.

B. STIPE VELVETY OR PRUINATE.

141. MARASMIUS LEUCOCEPHALUS Mont. Syll. Crypt. 1856.

Pileus membranaceous, convex then plane and depressed, at length infundibuliform, glabrous, white. Stipe cartilaginous, stuffed then hollow, pallid above, brownish below, villous-pruinose with pale tawny flocci, attached by a discoid base. Lamellae unequal, white, narrow in front and obtuse, broader behind, sinuate-adnate and long decurrent.

Growing on fallen sticks. Pileus 6-15 mm. in diameter, the stipe 2-3 cm. long.

142. MARASMIUS SEMISPARSUS Berkeley, Chall. Exp. 1875.

Pileus depressed, umber, gray-pulverulent, the margin naked and sulcate. Stipe umber, minutely tomentose, the base somewhat spongy. Lamellae distant, adnate-decurrent, concolorous.

Growing on the petiole of a dead leaf; Bermuda. Pileus about 4 mm. in diameter, the stipe 12 mm. long, twisted and compressed when dry.

143. MARASMIUS TOMENTOSIPES Peck, Bull. Torr. 1902.

Pileus thin, convex, afterward nearly plane, usually umbilicate, glabrous, the margin striate, yellow-brown or ferruginous, brown when dry. Stipe slender, hard, elastic, hollow, brown or black, tomentose. Lamellae narrow, rather distant, unequal, arcuate-decurrent, pale-yellow; spores elliptic, 6-7x3-4 mic.

Growing in coniferous woods; Idaho. Pileus 1-3.5 cm. in diameter. the stipe 2-4 cm. long and 1 mm. thick.

II. CLAVIFORMES. *Pileus membranaceous, campanulate or convex, never depressed.*

A. STIPE GLABROUS.

144. MARASMIUS ALBO-FUSCUS B. & C. Fungi Cub. 101.

Pileus plane, umbonate, thin, striate, reticulate, white, the center brown. Stipe solid, glabrous, slender, slightly thickened above. Lamellae few, distant, broad, adnate-decurrent, the interstices trabeculate.

Growing on logs in woods. Pileus 12 mm. in diameter, the stipe 2-3 cm. long.

145. MARASMIUS ALBICEPS Peck, 43 N. Y. Rep. 1889.

Pileus membranaceous, either convex or campanulate, glabrous, white. Stipe corneous, setiform, glabrous, black, paler at the apex, attached to the matrix by radiating brown hairs or fibers. Lamellae broad, distant, adnate- or arcuate-decurrent, white; spores obovoid or subelliptic, 6-8x3-4 mic. usually containing a shining guttule.

Growing among fallen leaves in woods. Pileus about 4 mm. in diameter, the stipe 2-3 cm. long.

B. STIPE VELVETY OR PRUINATE.

146. MARASMIUS CLAVAEFORMIS Berkeley, Lea's Cat. 1849.

Pileus convex, tough, white. Stipe slender, tapering downward and attached by a minute bulb, brown below, and clothed with a depressed velvety pubescence, thickened above and white sprinkled with furfuraceous particles. Lamellae distant, broad in front, behind long decurrent, whitish inclining to flesh-color.

Growing on dead sticks. Pileus 4 mm. in diameter, the stipe 2.5 cm. long.

147. MARASMIUS DECURRENS Peck, 24 N. Y. Rep. 1871. *Marasmius resinosus* Saccardo. Sylloge V.

Pileus thin, convex, minutely tomentose, grayish or tawny. Stipe slender, firm, equal, gray, minutely tomentose. Lamellae arcuate-decurrent, subdistant, narrow, tapering toward each end, whitish with discolored edge, interspaces rugose-reticulated.

Growing on the ground in a shaded ravine. Pileus 8-12 mm. in diameter, the stipe 3-5 cm. long and 1 mm. thick.

148. MARASMIUS ACULEATUS Patouillard, Bull. Soc. Myc. 1900.

Pileus convexo-campanulate, thin, coriaceous, semipellucid, densely orchaceous-tomentose; the hairs straight, convergent-fasciculate, thus forming stellate warts. Stipe slender, tapering upward, clothed with a short, velvety, ochraceous tomentum. Lamellae few, distant, broadly adnate, subdecurrent.

Growing on the ground; Guadaloup. Pileus 2 cm. in diameter, the stipe 2 cm. long. The pileus bristles with warts like those of a Lycoperdon.

§ 4. *PLEUROTUS. PILEUS MORE OR LESS IRREGULAR; THE STIPE EXCENTRIC, LATERAL OR WANTING. COMMONLY GROWING ON WOOD.*

A. STIPE EXCENTRIC.

a. Lamellae colored.

149. MARASMIUS PURPUREUS B. & C. Fungi Cub. No. 135. 1867.

Pileus convex then plane, thin, sulcate, tomentose, purple. Stipe excentric, very short, solid, thickened upward, whitish. Lamellae broad, distant, purple, adnexed, the interstices even.

Growing on stumps in woods. Pileus 2 cm. in diameter, the stipe 2-4 mm. long.

150. MARASMIUS CORACIPES B. & C. Fung. Cub. 93.

Pileus convex, thin, even, pale brown. Stipe subexcentric, concolorous with the pileus, rather thick, sulcate, glabrous. Lamellae close, narrow, unequal, adnexed, pale rufous.

Growing in woods. Pileus 12-15 mm. in diameter, the stipe 3.5-4 cm. long.

151. MARASMIUS OBLIQUUS B. & C. Fungi Cub. 136.

Pileus flabelliform, glabrous, polished, the margin involute. Stipe oblique, very short, cylindric. Lamellae distant, adnate-decurrent, brown when dry.

Growing on dead wood in ravines. Pileus 2 cm. in diameter, the stipe 2 mm. long.

b. Lamellae white.

152. MARASMIUS CAESPITOSUS Peck, 26 N. Y. Rep. 1873.

Pileus fleshy, convex, even, brown with a lilac tint, sometimes irregular. Stipe central or excentric, stuffed or hollow, pruinose. Lamellae close, free, somewhat united with each other at the stipe, narrowed outwardly, white.

Growing caespitosely on birch wood. Pileus 1-2 cm. in diameter, the stipe 3-5 cm. long.

153. MARASMIUS SEMIUSTIS B. & C. Fungi Cub. 102.

White, rufus when dried. Pileus excentric, convex then plane, rugose or sulcate, glabrous. Stipe short, compressed, glabrous. Lamellae distant, reaching the stipe, the spaces between rugose.

Growing on rotten wood. Pileus 8-12 mm. in diameter, the stipe 6-7 mm. long.

B. STIPE LATERAL AND VERY SHORT.

a. Lamellae colored.

154. MARASMIUS CURTISII Sacc. in Syd. Sylloge XIV. Marasmius haematodes B. & C. Fungi Cub. 139.

Pileus helmet-shaped, rigid, glabrous, deep red-brown. Stipe none. Lamellae venose, thick, concolorous.

Growing on dead sticks. Pileus 2 mm. in breadth.

155. MARASMIUS CONCOLOR B. & C. Fungi Cub. 138.

Pileus helmet-shaped, irregular, lobed, dull tawny, pulverulent. Stipe none. Lamellae broad, concolorous.

Growing on sticks in woods. Pileus 2-4 mm. in breadth.

156. MARASMIUS SABALI Berkeley, Chall. Exp. II. 1878.

Pileus reniform, tomentose, at length resupinate and culcate. Stipe very short. Lamellae thick, entire, rounded behind, distant, adnate; spores subglobose, 8 mic. in diameter.

Growing on petioles of Sabal Palmetto; Bermuda. The whole plant reddish when dry.

157. MARASMIUS ASPERIFOLIUS Patonillard, Jour. Bot. 1889.

Pileus sessile, resupinate or reflexed, glabrous, striate, pale brown. Lamellae distant, concolorous or paler, unequal, hirsute, attached to a hairy stipitiform tubercle, cystidia numerous, clavate, prominent.

Growing on bark of Murraya; Martinique.

158. MARASMIUS CALOSPORUS Pat. in *Duss.* En. 1903.

Pileus sessile, resupinate, at first pezizoid, then split and almost dimidiate, very thin, membranaceous, white, glabrescent. Lamellae few, white-yellowish, distant, radiating from an excentric point; spores ovoid, smooth, 10 x 7 mic.

Growing in clusters on rotten branchlets of Clibadium, Guadaloupe. Pileus minute, scarcely 2 mm. in breadth.

b. Lamellae white or pallid.

159. MARASMIUS MERULINUS B. & C. Fungi Cub. 133. *A.* (Collybia) Merulius Bertero ms. in Montagne, Flora Fernand. 1835.

"Lamellae in the center, agaricine, at the margin meruline." *Montagne.* It is said to differ from *M. spaniophyllus* by its white pileus.

Growing on sticks in woods; "Alabama." *Berk.*

160. MARASMIUS ARACHNOIDEUS B. & C. Fungi Cub. 137.

All white. Pileus resupinate, adnate, the stipe very short, at length obliterated, arising from an arachnoid mycelium. Lamellae few.

Growing on dead wood. Pileus 2 mm. in breadth.

161. MARASMIUS NIDULUS B. & C. Fungi Cub. 134.

Pileus resupinate, at first pezizaeform, at length free on one side, pruinose-floccose, white. Stipe very short, pruinose. Lamellae few, thick, ventricose.

Growing on sticks in woods. Pileus 2-6 mm. in breadth.

162. MARASMIUS HAWAIENSIS P. Hennings, Monsunia I. 1899.

Pileus membranaceous, tough, sessile, reniform or subflabellate, yellow-brown, subrugulose, the margin entire or incised. Lamellae radiating behind, rather broad, few, branched, reticulate, anastomosing, pallid.

Growing on trunks covered with mosses; Hawaia. Pileus 1-3 cm. broad, 1.5-2 cm. long.

UREDINEOUS CULTURE EXPERIMENTS WITH PUCCINIA SORGHI, 1905.[1]

W. A. KELLERMAN.

For three seasons previous, reports of infection experiments have been made dealing with quite a number of Rust species. This fourth report is, unfortunately, extremely brief; due to the fact that a Winter mycological collecting trip was made to Guatemala that lasted into Spring. Also other work that had been in the meantime neglected, demanded much time and, besides, class duties in college were pressing. Consequently nothing was carried to completion this season except the Maize Rust experiments which can be outlined in a few sentences.

First let me recur to the completed work with this species one year ago. At that time I secured what was taken to be infection of Maize plants direct with teleutospores (but below will be differently interpreted); and thereafter extended inoculation work was carried on with the uredospores so secured.

SUMMARY OF PREVIOUS WORK.

No inoculations with Maize Rust were on record previous to 1904. Work for that season was published in the *Journal of Mycology*, 11:26-33, Jan. 1905, and the point settled beyond possible doubt were these: That, using uredospores, the species was readily transferred to any and all the "agricultural species" of Maize; that teosinte (*Euchlaena luxurians*) was also a host for this species of Rust (not before reported); that attempts to inoculate *Sorghum vulgare*, *Saccharum officinarum*, and *Tripsicum dactyloides* were unfruitful.

AN AECIDIUM NOT DETECTED.

In the progress of the work no Aecidium was encountered, though spores were taken from teleutosporic pustules that had been exposed all winter (on sweet corn), and with sowings

[1] Contributions from the Botanical Laboratory of the Ohio State University, XXIII.

therefrom uredospores were obtained also later teleutospores. The pustules were cursorily examined before used and nothing was observed but teleutospores.

DR. ARTHUR'S DISCOVERY OF THE AECIDIUM.

Before my work was published Dr. Arthur had the rare good fortune to demonstrate the aecidium stage of the Maize Rust. Twice I had, as I supposed, obtained uredospores by using teleutospores direct on Maize plants — and scant material yet remaining enabled me to get a *third inoculation* with spores from my teleutosporic pustules. As far as seemed consistent with probable success in this third attempt at inoculation the pustules were disintegrated and the mass of spores (with loss of course) was subjected to microscopic scrutiny; but no uredospores were seen. Doubtless further search should have been made — uredospores *might have been found,* and that, of course, would have been of far greater value than the successful inoculation. Dr. Arthur used aecidiospores of Oxalis to inoculate Maize. The final link in the absolutely complete demonstration was this only — to use teleutospores of Maize rust to secure the aecidium on Oxalis. This I did.

WORK WITH THE TELEUTOSPORES IN 1905.

The chain of evidence was in fact complete — or at least neither Dr. Arthur nor myself longer could doubt that the life cycle of this Rust included three stages — aecidium, uredo and teleuto. Confidently therefore on my return from Guatemala I instituted experiments in the month of April and early in May, using teleutospores from sweet corn that had been exposed all winter. In due time the several Oxalis plants on which sowings were made responded generously and repetitions were equally satisfactory.

REPETITION OF FORMER WORK.

The theory I proposed one year ago, namely, that an aecidium might be suppressed at will (or under circumstances), I now abandon. It is very probable that *a few uredospores* viable were harbored by the teleutosporic pustules and these in that case of course gave the inoculation of the Maize. Uredosporic inoculation as shown by numerous experiments later was not difficult, but a very certain result to be anticipated whenever spores fell, or were placed, on the proper host.

SIGNIFICANCE OF THE PHENOMENA OF UREDOSPORIC INOCULATION.

The surprise that the rather rare aecidium of Oxalis should belong to the very common and very abundant Rust of Maize was shared by many mycologists. But the reinterpretation of my work — which does not seem irrational — clears up the mat-

ter. Doubtless then the Rust of Maize is carried over from year to year in part by means of surviving uredospores. Finally, it may be said that while this interpretation was, of course, not unthought of by uredinists, I preferred myself to record the final judgment only after further work had been carried on in my own experimental laboratory. Therefore this is the conclusion of the whole matter.

CULTURES OF UREDINEAE IN 1905.[1]

BY J. C. ARTHUR.

The present article forms the sixth of a series of reports[2] by the author upon the culture of plant rusts. They cover the years from 1899 to the present year, inclusive. In these studies the grass and sedge rusts hold a prominent place, but other heteroecious and autoecious species have been included, and during the present season the work has been extended to the so-called *opis, micro* and *lepto* forms, and also to species with amphispores.

The coöperative agreement between the Bureau of Plant Industry of the U. S. Department of Agriculture and the Indiana Experiment Station, which existed for carrying on the culture work in the spring of 1904, was again established, extending from July, 1904, to April 30, 1905, making it possible to have an assistant during this period, who devoted nearly his whole time to the study of the rusts. The position was first held by Mr. J. C. Marquis, who was succeeded on October 1, 1905, by Mr. Frank D. Kern, and after the expiration of the coöperative agreement Mr. Kern was retained by the Experiment Station to continue the work. After May 10 all the work fell upon Mr. Kern until September, covering the most important part of the culture period, the author being absent in Europe. It could not, however, have been entrusted to better hands, as the fine ability displayed in the work during the previous season, coupled with considerable experience already acquired, enabled him to meet the new conditions as they arose, and the judgment and caution indispensable in securing authoritative results.

Much of the completeness of the work is due to the kindly assistance of correspondents, who have sent teleutosporic material, and especially to Messrs. E. Bethel, Denver, Colo.; J. M. Bates, Red Cloud, Neb.; A. O. Garrett, Salt Lake City, Utah;

[1] Read before the Botanical Society of America at the New Orleans meeting, January 1, 1906.

[2] See Bot. Gaz. *29*: 268-276; Jour. Mycol. *8*: 51-56; Bot. Gaz. *35*: 10-23; Jour. Mycol. *10*: 8-21 and *11*: 50-67.

J. J. Davis, Racine, Wis.; E. Bartholomew, Rockport, Kansas; H. H. Whetzel and H. S. Jackson, Ithaca, N. Y.; C. L. Shear and P. L. Ricker, Washington, D. C.; Wm. J. Horne, Santiago de las Vegas, Cuba; Jos. J. Wolfe, Durham, N. C.; Lewis Kaufman, Morrison, Iowa; R. D. Echlin, Washington, Iowa; R. E. Buchanan, Ames, Iowa; H. L. Bolley, Fargo, N. D.; and H. L. Shantz, Lincoln, Neb.; to whom my warmest thanks are extended. I am also much indebted to Messrs. Bethel and Garrett for rooted wild plants on which to make sowings, and to Dr. Davis for field observations and the suggestion which led to successful sowings of *Puccinia Eleocharidis.*

During the present season 85 collections of material with resting spores and 15 collections with active spores were employed, from which 484 drop cultures and 13 Petri dish cultures were made to test the germinating condition of the spores, these being made almost wholly from the resting spores. Out of the 85 collections with resting spores 32 could not be made to germinate, although every condition seemed favorable, and were therefore useless. There were in all 194 sowings of spores made, representing 45 species of rusts, and for this purpose 100 species of hosts were utilized, which were grown temporarily in pots in the greenhouse.

A few cultures were made with heteroecious species for which no clue to the alternate host had been obtained, and with one exception the results were negative. These negative trials are here recorded to serve for reference.

1. PUCCINIA on *Carex Pennsylvanica,* sent by Rev. J. M. Bates from Red Cloud, Neb., was sown on *Urtica gracilis* with no infection. Similar material in former seasons has been tried on twenty-one other species of hosts with negative results.[3]

2. PUCCINIA EMACULATA Schw. on *Panicum capillare* L. from Lafayette, Ind., was sown on *Ambrosia artemisiaefolia, Rudbeckia triloba, R. laciniata* and *Steironema ciliatum,* with no infection. This very common and distinctive rust was sown in former seasons on fourteen other species of hosts with negative results.[4]

3. PUCCINIA TOSTA Arth., on *Sporobolus asperifolius,* sent from Denver, Colo., by Mr. E. Bethel, was sown on *Napaea dioica Symphoricarpos racemosus, Xanthoxylum Americanum, Aesculus glabra* and *Viola papilionacea,* with no infection. Sowings of what is taken to be the same species of rust, but on

[3] See Jour. Mycol. *10*: 10. 1904; and *11*: 51. 1905.

[4] See Jour. Mycol. *8*: 52. 1902; Bot. Gaz. *35*: 12. 1903; and Jour. Mycol. *10*: 10. 1904.

another host, were made in 1903 on six other species of hosts with negative results.[5]

4. Puccinia Crandallii Pamm. & Hume, on *Festuca confinis,* sent from Boulder, Colo., by Mr. E. Bethel, was sown on *Dodecatheon Meadia, Hydrophyllum appendiculatum, Aquilegia Canadensis, Anemone Canadensis, Thalictrum dioicum, Rudbeckia triloba, Gutierrezia Sarothrae,* and *Lonicera Japonica,* with no infection.

5. Uromyces graminicola Burr. on *Panicum virgatum,* sent from Red Cloud, Neb., by Rev. Bates, was sown on *Psoralea Onobrychis,* with no infection; while similar material sent by Mr. Bartholomew from Stockton, Kans., was sown on the same host and also on *Cassia Chamaecrista, Polemonium reptans* and *Rudbeckia laciniata,* all with no infection.

6. Uromyces Junci (Schw.) Tul. on *Juncus effusus,* sent by Mr. Jackson from Ithaca, N. Y., was sown on *Rudbeckia laciniata, R. triloba,* and *Falcata comosa,* with no infection. What is believed to be the same species of rust, but on another host, was sown in 1902 on a species of *Iris* with negative results.

The following species of rusts were successfully grown, and the data supplement that obtained from previous cultures of this series, or that published by other investigators obtained by means of similar cultures. The results in connection with *Puccinia Pruni-spinosae,* the plum rust, are especially interesting, being the first studies of the kind with American material.

1. Melampsora Medusae Thuem.— Teleutosporic material obtained near Lafayette, Ind., on *Populus deltoides* was sown April 17 on *Larix laricina* and *L. decidua,* which resulted in abundance of spermogonia appearing April 25, and a greater abundance of aecidia May 1, upon both hosts.[6]

2. Gymnosporangium Juniperi-Virginianae Schw.— Three samples of teleutosporic material were used, one from the eastern states, and two from the central west. The test was designed to show whether any difference existed between the two regions in the power of the species to infect the cultivated apple; the apple orchards of Iowa and the central west generally being well known to be especially free from this rust. All the teleutosporic material was on *Juniperus Virginiana,* and to all appearances equally good. That sent from Durham, N. C., by Mr. Wolfe, was sown on a seedling apple out of doors April 27, and showed abundant spermogonia May 9, but did not develop

[5] See Jour. Myc. *10*: 10. 1904.
[6] See Jour. Mycol. *10*: 13. 1904; and *11*: 52. 1905.

aecidia, although conditions appeared favorable. Material from Washington, Iowa, sent by Rev. Echlin, was sown April 22, on a small plant of the York Imperial apple in the greenhouse, and showed abundant spermogonia on May 5; another sowing was made out of doors on a seedling apple April 27, and showed spermogonia on May 13, but further observation was prevented by insect depredation. A second lot of material was received from Ames, Iowa, sent by Mr. Buchanan, and was sown out of doors on seedling apple and *Crataegus coccinea,* and in the greenhouse on *Amelanchier Botryapium.* The sowing on apple gave abundant spermogonia, but failed to make further development, while on the other hosts there was no infection. So far as these tests go there appears to be no difference between the eastern and western forms of the species in their power to infect the cultivated apple. Many cultures have been made showing the full life cycle of this rust (often called *G. macropus*). A good summary of the subject, especially in reference to the question underlying the present work, was given a short time ago by Professor Pammel[7] of the Iowa State College.

3. Puccinia Sambuci (Schw.) Arth. — Teleutosporic material of fine quality on *Carex lupulina,* collected in Noble county, near Beavor Dam, Ind., was sent by Mr. Whetzel. It was sown on *Sambucus Canadensis* May 8, giving rise to abundant spermogonia May 14, and aecidia May 25.

4. Puccinia albiperidia Arth. — Teleutosporic material was gathered near Lafayette, Ind., on *Carex tetanica,* and sown April 7 on *Silphium perfoliatum, Polemonium reptans, Ambrosia trifida, Rudbeckia laciniata, Steironema ciliatum,* and *Ribes gracile.* Only the last host showed infection, giving abundant spermogonia April 14, and aecidia April 27, the others remained entirely free from rust.

A part of the teleutosporic material was sent to Dr. H. Klebahn, Hamburg, Germany, who sowed it on *Ribes Uva-crispa, R. aureum* and *R. rubrum.* No infection resulted on *R. rubrum,* but on *R. Uva-crispa* spermogonia showed May 8, and on *R. aureum* May 15. The further development, however, was slow, soon coming to naught in the first case, and persisting much longer, but with little advance in the second case. Dr. Klebahn in commenting upon his results says that the imperfect development of the infection on *R. uva-crispa* may be ascribed, in part at least, to the late sowing, for the teleutospores germinated freely. The host plants had already passed the most active period of growth, and the weather was too warm. His results are exactly in accord with our own under similar conditions. The

[7] Bull. Iowa Exper. Sta., No. 84: 16-24. August, 1905.

failure to secure good aecidia made it impossible to give an opinion on the identity of this species of rust,[8] as compared with European forms.

5. Puccinia Caricis-Solidaginis Arth. — Teleutospores on *Carex sparganioides* gathered near Lafayette, Ind., were sown April 22 on *Aster paniculatus* and again on May 11 on *A. paniculatus, A. Drummondii, Ribes rotundifolium, Urtica gracilis,* and *Solidago Canadensis.* No infection occurred except on the last host, this giving spermogonia May 18 and aecidia May 28 in very great abundance. In 1902 cultures of this species were made with teleutospores taken from *Carex Jamesii* and *C. stipata.*[9]

6. Puccinia Peckii (DeT.) Kellerm. — Teleutosporic material on *Carex lanuginosa,* gathered at Red Cloud, Neb., by Rev. Bates, was sown May 19 on *Hydrophyllum appendiculatum, Steironema ciliatum,* and *Onagra biennis.* On May 26 spermogonia, and May 31 aecidia appeared on *O. biennis,* the other hosts remaining entirely unaffected. This result is a duplicate of that obtained in 1904.[10].

7. Puccinia Caricis (Schum.) Reb. — Teleutosporic material on *Carex stipata,* gathered near Lafayette, Ind., was sown April 18 on *Urtica gracilis,* and gave spermogonia April 24, and aecidia May 1, in great abundance.

A collection in excellent condition made at Denver, Colo., by Mr. Bethel, on *Carex aquatilis,* was sown on *Urtica gracilis* April 10, giving few but well developed spermogonia April 18, and numerous aecidia April 29. It was sown again April 25, and gave abundant spermogonia May 1, followed with very numerous aecidia May 8.

Both of these sowings were tried on the evidence of the microscopic examination of the collections. It was found that the medium-sized teleutospores, and large uredospores found intermixed, agreed with those known to belong to this species, and the results confirmed the diagnosis. Both collections give new hosts for the species.[11] More interesting still was the presence in the Colorado collection of abundant amphispores, which agree in every particular with those collected on *Carex stricta* by C. H. Peck in New York, distributed in Thuemen's *Myc. Univ., No. 746,* and first called *Uromyces Caricis* Pk., then *Puccinia Caricis-strictae* Diet. This fortunate collection enables us to show beyond a reasonable doubt, that the *Uromyces Caricis*

[8] For record of previous cultures see Jour. Myc. *8*: 53. 1902; *10*: 11. 1904; and *11*: 58. 1905.

[9] See Bot. Gaz. *35*: 21. 1903.

[10] Jour. Mycol. *11*: 58. 1905.

[11] For previous cultures see Bot. Gaz. *29*: 279. 1900; *35*: 16. 1903; and Jour. Mycol. *8*: 52. 1902.

of Peck is the amphisporic form of *Puccinia Caricis*. What determines the production of amphispores in this species is an interesting question, in view of the fact that only twice have they been found, and at such a great distance apart. The amphispores in the Colorado collection did not germinate in drop culture, although the same conditions gave fine germination of the associated teleutospores.

8. PUCCINIA FRAXINATA (Schw.) Arth. — A collection of teleutospores on *Spartina cynosuroides*, sent by Mr. Bartholomew from Hill City, Kans., was used to sow April 29, on *Fraxinus lanceolata, Adelia acuminata* and *Ligustrum vulgare*. Only the first host gave results, showing spermogonia May 5, and aecidia May 14, the sowing being made on a cut branch placed in water in the greenhouse.[12]

9. PUCCINIA AMPHIGENA Diet. — Teleutosporic material on *Calamovilfa longifolia* sent by Rev. Bates from Red Cloud, Neb., was sown on *Smilax hispida* May 27, and began to show spermogonia June 2, and aecidia June 10, both in abundance.[13]

10. PUCCINIA VERBENICOLA (E. & K.) Arth. — Teleutosporic material on *Sporobolus longifolius*, sent from Red Cloud, Neb., by Rev. Bates, was sown on *Verbena urticaefolia* May 3, and showed spermogonia May 9, and aecidia May 20. Another collection on same host, obtained near Lafayette, Ind., was sown on same species of *Verbena* May 27, and showed spermogonia June 2, and aecidia June 10.[14]

11. PUCCINIA PUSTULATA (Curt.) Arth. — Teleutosporic material on *Andropogon furcatus*, gathered by the writer at English Lake, Ind., was sown on *Pentstemon hirsutus* and *Comandra umbellata* May 27, with no infection of the *Pentstemon*, but abundant growth on the *Comandra*, spermogonia appearing June 2, and aecidia June 14. This result confirms work done in 1903.[15]

12. PUCCINIA PAMMELII (Trel.) Arth. — The cultural results of 1904[16] were verified by sowing teleutospores from *Panicum virgatum*, obtained by the writer at English Lake, Ind., upon*Euphorbia corollata*. A sowing was made May 26, giving spermogonia June 2, and aecidia June 9.

13. PUCCINIA SUBNITENS Diet. Teleutosporic material on *Distichlis spicata*, sent from Red Cloud, Neb., by Rev. Bates, was

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[12] For previous cultures see Bot. Gaz. *29*: 275. 1900; and Jour. Mycol. *11*: 57. 1905.

[13] For previous cultures see Bot. Gaz. *35*: 20. 1903; and Jour Mycol. *10*: 11. 1904.

[14] For previous cultures see Bot. Gaz. *29*: 274. 1900; *35*: 16. 1903; and Jour Mycol. *11*: 56. 1905.

[15] Jour. Mycol. *10*: 17. 1904.

[16] Jour. Mycol. *11*: 56. 1905.

sown on *Erysimum asperum, Sophia incisia,*[17] *Lepidium Virginicum,* and *Bursa Bursa-pastoris,* with success in each case. The sowing was made April 18, and spermogonia appeared on *Eryisimum* and *Sophia* April 25, *Lepidium* April 26, and *Bursa* April 27, while aecidia were observed on all by May 8. The aecidia develop with considerable difficulty on *Bursa,* and Rev. Bates writes that they are not common or abundant in the field on this host. On *Lepidium* they also start with less ease than on the other species, but under good conditions grow well.[18]

14. PUCCINIA POCULIFORMIS (Jacq.) Wettst. — Teleutosporic material on *Agrostis alba,* sent from Ithaca, N. Y., by Mr. Jackson, was sown on *Berberis vulgaris* April 13, and showed numerous spermogonia April 22, with abundance of aecidia May 4.

15. PUCCINIA SORGHI Schw. — The work of last year,[19] in which only aecidia were used, was verified this season by sowing teleutospores. The material was obtained in Lafayette from an early garden variety of sweet corn. It was sown April 17 on *Oxalis cymosa* (the common wild wood sorrel of the region), *O. Ortgiesii* (a yellow-flowered greenhouse weed), *O.————*, (a tuberous pink-flowered form of greenhouses), and *O. Bowiei* (a pink-flowered form with large flowers and leaves, also grown in greenhouses.) All remained free, except *O. cymosa,* which showed numerous spermogonia on April 27, and aecidia on May 5. A second sowing was made May 1 on *O. cymosa, O. Origiesii, O. Bowiei, and O. corniculata* (growing out of doors over a grass-covered conduit for steam pipes), and again all remained free except *O. cymosa,* which gave spermogonia May 8, and eacidia May 14. It is not apparent why no infection should occur on the four hosts other than *O. cymosa,* but there is no reason to suppose that it was due in any degree to lack of vigor or suitable conditions.

The aecidiospores raised in the first trial above were sown May 6 on seedlings of the yellow dent field corn variety of *Zea Mays,* and in a week, May 13, showed uredospores, which increased in abundance until teleutospores were observed June 15. The uredospores from this culture (on yellow dent corn) were sown May 16 on small plants of garden sweet corn, and gave

[17] This is probably not the correct name of the plant used for the cultures. It is, however, the name also used last year for the trial host, which is the common species of *Sophia* in this region, and the error in determination is due to the confusion existing in the current manuals. The species is also different from the one on which the fungus was collected last year in Nebraska by Rev. Bates (Jour. Mycol. *11*: 116. 1905), and that is also incorrectly named. But for the sake of simplicity the name *S. incisa* will be used in this article for both species.

[18] For previous cultures see Bot. Gaz. *35*: 19. 1903; and Jour. Mycol. *11*: 54. 1905.

[19] Bot. Gaz. *38*: 64. 1904.

uredospores in plenty on May 23, and would doubtless have been followed by teleutospores in due time, had the culture been continued. These results in transferring the rust from field corn to sweet corn, and the reverse, are in accord with those obtained by Kellerman.[20]

At the same time the first sowings were made, April 17, teleutospores were also sown on a seedling *Zea Mays,* under favorable conditions, but no infection resulted. The drop cultures, which are made just previous to every sowing, showed that the teleutospores germinated freely, but the few uredospores intermixed were not viable. In this case, at least, the teleutospores appeared to be incapable of infecting the host from which taken, and in so far agree with the general rule regarding grass and sedge rusts.

16. Puccinia Polygoni-amphibii Pers. — In 1904[21] it was possible to verify in a measure the work upon this species by Dr. Tranzschel of St. Petersburg, by sowing aecidiospores from *Geranium maculatum* and obtaining teleutospores on *Polygonum emersum.* This season the reverse order of sowing was tried. Teleutospores from *P. emersum* obtained in this vicinity were sown April 15 on *G. maculatum* and *G. Robertianum,* with no infection of the latter, but most abundant infection of the former, showing spermogonia April 23 and aecidia May 1. A second sowing was made April 27, using the above two hosts and also *G. pusillum,* and again infection occurred only upon *G. maculatum,* which showed great numbers of spermogonia May 3, and aecidia May 9. These results agree with common observation, for the aecidium on *G. maculatum* (*A. sanguinolentum* Lindr.) is common in the United States, while no aecidia have yet been reported on *G. Robertianum* or *G. pussillum.*

17. Puccinia Helianthi Schw. — A sowing of teleutospores, taken from *Helianthus grosse-serratus* growing on the grounds of the University, was made May 17 on *H. grosse-serratus* and two plants of *H. annuus* with equally abundant results in each case, spermogonia showing May 25, and aecidia June 2.

18. Puccinia lateripes B. & Br. — After many vain attempts to secure good fungous and host material of this species for culture work, the present season's excellent results have given much satisfaction. All the material was obtained near Lafayette, Ind. Sowings of teleutospores from *Ruellia ciliosa* were made April 25 on both *R. ciliosa* and *R. strepens,* with equally positive results in both cases, showing spermogonia May 5, and aecidia May 18. Another sowing of the same material was made on *R. strepens* May 27, which gave spermogonia June 5, and aecidia

[20] Cf. Jour. Mycol. *11*: 27. 1905.
[21] Jour. Mycol. *11*: 59. 1905.

June 15. A sowing of teleutospores from *R. strepens* on *R. ciliosa* May 8, and another June 7, gave no infection.

Many writers, following Lagerheim, who received his clue from Burrill, have made two species of the rusts on these two hosts. It is true that the gross appearance, and to some extent the microscopic characters of the two are perceptibly different. These differences are shown, so far as the development went, in the results of the cultures. The aecidial groups grown on *R. ciliosa* were small and round, one to two millimeters across, without noticeable hypertrophy of the tissues, and confined to the blade of the leaf. On *R. strepens,* however, they took possession of the veins, petioles and stems, and made large swellings from 20 to 25 millimeters long, and in one case the main steam for a distance of ten centimeters or more was greatly swollen and distorted. The differences also extended to the peridial cups and to the spores. On *R. ciliosa* the cups were mostly one-half millimeter high, and on *R. strepens* fully one millimeter high. The aecidiospores from *R. ciliosa* measured 15-19 by 20-26μ, and from *R. strepens* 17-21 by 24-30μ. These two cultures were from the same source of infection, and must therefore be one and the same species. Had uredospores and teleutospores been raised, it is believed that the differences recorded in the books for the two hosts would have been found. In short it is believed that the differences of size and appearance are entirely due to the influence of the hosts. The loose, somewhat succulent tissues of *R. strepens,* and its vigorous habit of growth, are correlated with the greater development of the fungus, while the firm close tissues of *R. ciliosa,* not only prevent luxuriant development of the parasite, but its parts become smaller throughout. These differences in the hosts also account for the failure to infect *R. ciliosa* with spores from *R. strepens,* while the reverse process succeeded. There appears to be no reason to doubt that under very favorable conditions the infection of *R. ciliosa* with spores from *R. strepens* could be accomplished, and the resulting development be the same as when the infecting spores came from *R. ciliosa* itself.[22]

19. Puccinia Pruni-spinosae Pers.— The *Aecidium punctatum* Pers. (*A. quadrifidum* DC.) occurring in various parts of the United States and Canada on different species of *Anemone, Hepatica* and *Thalictrum* so closely resembles the European form which bears the same name, that little doubt has existed of their genuine identity. In 1904 Dr. Tranzschel[23] of St. Petersburg made cultures of this aecidium, sowing the aecidiospores from *Anemone coronaria* on *Amygdalus communis* (almond) *Prunus spinosa* (blackthorn), *P. divaricata* (cherry-

[22] For previous cultures see Kellerman in Jour. Mycol. 9: 107. 1903.
[23] Trav. Mus. Bot. Acad. Sci. St. Petersb. 11: 67-69. 1905.

plum) and from *Anemone ranunculoides* on *P. spinosa,* producing in each the characteristic uredospores of *Puccinia Pruni-spinosae,* the rust of plums and peaches.

This work by Dr. Tranzschel suggested the following trials with American material. Aecidiospores from *Hepatica acutiloba* (*Aecidium hepticatum* Schw.) were sown on three small plants of *Prunus serotina* (wild black cherry), established in pots in the greenhouse, on *Prunus Americana* (native plum), *P. Cerasus* (cultivated cherry), and *Amygdalus Persica* (peach), the last two seedlings. The sowings were made May 1 to 4, and in fifteen days afterward, uredospores appeared on *P. serotina,* but the other plants remained wholly free, watch being continued for a month and more. The successful sowings were as follows:

May 1, Aecidiospores sown on *P. serotina;* May 16, uredospores; May 22, teleutospores.
May 1, Aecidiospores sown on *P. serotina;* May 16, uredospores.
May 2, Aecidiospores sown on *P. serotina;* May 17, uredospores.

On May 23, a sowing of uredospores, which had been grown on *P. serotina,* was made on *A. Persica,* under seemingly most favorable conditions, but no infection took place, watch being kept for two months.

From these results there can be no further question of the general identity of the American and European plum and cherry rusts, and their connection with the *Aecidium punctatum.* It is not possible to state what significance is to be attached to the failure to infect peach, plum and cultivated cherry with spores that readily infected the wild cherry. Careful search for two seasons in the vicinity of the diseased hepaticas, the fungus being perennial, has failed to detect any rust on plums, cherries or peaches, wild or cultivated, although growing in plenty; and furthermore *Puccinia Pruni-spinosae* has not yet been reported from Indiana, although said to occur in the adjoining state of Illinois on *P. serotina, P. Virginiana,* and *P. Americana.*

20. Puccinia Xanthii Schw. — Teleutosporic material on *Xanthium Canadense,* gathered near Lafayette, Ind., on Nov. 5, 1904, was sown on the second and third leaves of seedlings of the same species of host April 3. On April 8 small yellow dots began to show, which closely simulated spermogonia, but which microscopic examination by means of sections proved were only the very young teleutosporic sori. The yellow dots increased in size, appearing like small pimples, and finally broke through the epidermis, exposing the teleutospores April 21, eighteen days after inoculation. Another sowing was made April 13, on the cotyledons of the same species of host, and on the second leaves of *Ambrosia trifida.* The *Xanthium* seed-leaves showed yellow dots on April 22, and open sori May 1, also in eighteen days from sowing, but the *Ambrosia* leaves remained free.

These results agree essentially with those reported by Carleton,[24] who was able to infect *Xanthium* in eighteen and fourteen days, but could not infect *Ambrosia*. He says, however, that "in all these cases spermogonia preceded the teleutospores in the infected spots." In connection with an account of cultures with *Puccinia heterospora* he adds that "numerous experiments were also made with other *lepto* species, including *Puccinia Grindeliae* Pk., *P. variolans* Hark., *P. Lygodesmiae* E. & E., and *P. Sherardiana* Korn., with results similar to those above mentioned," but he does not report the details of these cultures, if such they were.

Taking the observations here recorded for *P. Xanthii*, especially in connection with those for *P. Silphii* and *P. Grindeliae*, reported below, it seems safe to assume that these species, and those quoted as mentioned by Carleton, belong to a group of rusts in which teleutospores and their resulting sporidia are the only spore-forms produced in the life-cycle, aecidia, uredo, and even spermogonia being wholly absent.

The following nine species have never been tested before by the culture method, so far as the writer knows, either in this country or abroad. They embrace an interesting diversity of habit. Besides the grass and sedge forms, with which this series of cultures has been most concerned, there are two leptopucciniae, one micropuccinia and one brachypuccinia, also one of the grass rusts is chiefly interesting for its amphispores.

1. Puccinia Silphii Schw. — Teleutosporic material was gathered March 31, 1905, near Lafayette, Ind., on dead and weathered leaves of *Silphium integrifolium*, and sown April 10 on vigorous plants of the same host, and also on *S. perfoliatum*. There was no infection on the latter host, but on the former clear yellow dots showed April 15, which sectioned and placed under the microscope proved to be very young teleutosori. These yellow dots rapidly enlarged, forming pale pimples scattered over yellow patches of the leaf, with much hypertrophied tissues, and April 20 broke through the epidermis, exposing the abundant teleutospores. Another sowing on the same two hosts was made April 25, and with the same results: there was no infection of *S. perfoliatum*, and the most abundant infection of *S. integrifolium*, showing as yellow dots May 2, and exposed teleutospores May 5. As the rust occurs on both these species of *Silphium*, and many others as well, the results may be taken as indicative of biological races.

2. Puccinia Grindeliae Pk. — Excellent teleutosporic material on *Gutierrezia Sarothrae* was sent by Mr. Bethel, collected

[24] Bulletin Bureau Pl. Industry, No. 63: 26. 1904.

at Boulder, Colo., March 27, 1905, on weathered stems. Mr. Bethel also kindly sent growing plants of the host and of *Chrysothamnus nauseolus.* The latter is not a recorded host for *P. Grindeliae,* but for a similar species, *P. tuberculans* E. & E. A sowing was made on *G. Sarothrae* April 12, which showed yellow dots April 21, and numerous open teleutosori May 2. Another sowing was made on both hosts April 26, with no infection on *C. nauseolus,* but most abundant infection on *G. Sarothrae,* showing yellow dots May 4, and open teleutosori May 15. The yellow dots were investigated, as in the other instances, and found to be the early stages of teleutosori, with no trace of spermogonia.

3. Puccinia Solidaginis Pk. — Teleutosporic material was sent by Mr. Garrett, collected at Salt Lake City, Utah, on *Solidago trinervata,* April 8, 1905. It was sown on *S. Canadensis* May 17, showing yellow dots June 2, and an abundance of open teleutosori June 7, with considerable hypertrophy of the tissues. Although the yellow dots were not specially investigated, they gave the same appearance of being young sori, as in the above species of leptopucciniae.

4. Puccinia transformans E. & E.— Remarkably fine teleutosporic material, forming considerable excrescences on leaves and stems of *Stenolobium Stans* (*Tecoma Stans*), was sent by Mr. Horne, who collected it at Santiago de las Vegas, Cuba, May 3, 1905. It was sown on two young plants of *S. Stans* May 13, and in both cases gave abundance of spermogonia May 29, and of teleutospores June 5.

Fine material gathered by Mr. J. B. Rorer on the pods of *S. Stans* in the Bahama Ids., at Nassau, New Providence, March, 1904, was sent for identification. The pods contained many seeds, which were planted in the greenhouse, and provided the host plants for the above inoculations. The teleutospores of this collection were in good germinating condition. As there were no growing plants of *S. Stans* at hand, they were sown May 20 (1904) on vigorous young plants of *Campsis radicans* (*Tecoma radicans*), but gave no infection, although the conditions seemed particularly favorable.

Since the cultures were made a study of the characters of the species has been undertaken, and the conclusion reached that all North American collections, so far as known, belong to *P. transformans* (*P. exitiosa* Syd. & Holw.). An original specimen of *P. transformans,* collected in Baja California by K. Brandegee in 1893 *on Tecoma Stans,* has been examined, and found to agree with other specimens on the same host from the West Indies, and also with the type material of *P. exitiosa* on *Tecoma mollis,* that is *Stenolobium mollis,* from Mexico. The species possesses considerably smaller spores, with thinner walls and finer sculp-

turing, than *Puccinia elegans* Schröt., reported only from Argentine, South America, an original specimen of which I have been able to examine through the courtesy of Dr. P. Hennings of the Botanical Garden, Berlin. *P. transformans* has not yet been reported from any locality in the United States.

5. Puccinia Kuhniae Schw. — Teleutosporic material, gathered near Lafayette, Ind., Nov. 3, 1904, on *Kuhnia eupatorioides,* was sown on the same host May 19. On May 28 spermogonia appeared sparingly, which were examined under the microscope in section, and these were followed June 5 by uredo in fair abundance. The species, therefore, belongs to the group of brachypuccinia.

6. Puccinia canaliculata (Schw.) Lagerh. — An observation in the field made in 1904 led to the present successful cultures. Aecidia were found in remarkable abundance on seedling *Xanthium Canadense* over an area 8 to 10 meters in diameter, beyond which the aecidium did not occur, although the hosts were equally plentiful and equally exposed. Later in the season, the middle of June, uredosori were found upon what appeared to be a seedling sedge extending over approximately the same area that had been occupied in the spring by the cocklebur cluster cups, and this was followed in August by teleutosori. Although the sedge did not fruit, yet it was not difficult to ascertain that it was a species of *Cyperus,* and the rust *Puccinia canaliculata.*

On May 11 a sowing of aecidiospores, obtained from the locality mentioned, was made in the greenhouse on *Cyperus esculentus,* other species of the genus not being at hand, and on June 2 uredo were noticed, although they probably appeared earlier and were overlooked, being small and pale. Another sowing was made on the same species of host May 17, and uredo first noticed June 2. The plants did not grow well, and the infected leaves were removed for the herbarium before time enough had elapsed in which to develop telutosori. Cultures with teleutosporic material will doubtless confirm this association of the *Xanthium* and *Cyperus* rusts.

7. Puccinia Eleocharidis Arth.— Teleutosporic material on *Eleocharis palustris* was sent by Dr. Davis from Racine, Wis., and with it the information that from observations in the field he believed this to have its aecidial phase on *Eupatorium.* Acting upon this suggestion, a sowing was made May 5 on *Eupatorium perfoliatum,* which gave rise to spermogonia May 13, and aecidia May 22. Another sowing on the same species of host May 11, gave spermogonia May 20, and aecidia May 30. Both trials produced an abundance of aecidia, with all the characteristics of the common and widely distributed form on this host, and closely related species.

8. Puccinia substerilis E. & E. — Fine material on *Stipa viridula* collected in August, 1904, at Boulder, Colo., was sent by Mr. Bethel, who also sent living plants of *S. viridula* and *S. comata.* This material showed a great abundance of amphispores,[25] but almost no teleutospores. The amphispores gave good germination, and were sown April 6 on *S. viridula* and *S. comata.* Uredospores of the usual kind began to appear on *S. viridula* April 18, but no infection on *S. comata.* Another sowing was made April 22 on *S. comata,* which also gave no infection. Uredospores continued to form for a month on *S. viridula,* but no amphispores or teleutospores were produced.

Mr. Bethel also sent fine teleutosporic material on *Stipa comata,* collected in March, 1905, at Boulder, Colo. This was sown on *Aster ericoides* April 18, and contrary to expectation gave no infection. When the failure became assured, it was sown again, April 29, on *A. ericoides, A. multiflorus,* and *A. Novae-Angliae,* but in each case without infection. This negative result throws some doubt on the assumption that the American *Stipa* rusts on the several species of hosts belong to one species, having its aecidia on certain species of *Aster,*[26] and the present very incomplete report is therefore entered under the name *P. substerilis.* Reducing this name to a synonym of *P. stipae,* as the writer did a few months since,[27] is now believed to have been premature.

9. Puccinia Seymouriana Arth. — At the time this species was published,[28] it was suggested upon grounds of spore resemblance that its *Aecidium* was *A. Cephalanthi* Seym. From combined morphological and geographical data I was then willing to assert that "although cultures must be awaited, yet there can be little doubt that the early stages of *P. Seymouriana* occur upon *Cephalanthus.*" Persistent efforts to secure material for this trial were finally rewarded by the writer finding especially good teleutospores on *Spartina cynosuroides* at English Lake, Ind., in the northern part of the state, in March, 1905. These were sown on *Polygala Senega* April 20, with no infection, and later on *Cephalanthus occidentalis,* May 13, with abundant results. On May 18 great numbers of spermogonia began to show, and on May 27 still greater numbers of aecidia, thus verifying the prediction made three years before.

10. Uromyces acuminatus Arth. — Finding the aecidium of this very common rust was due to a fortunate accident. Of the many trials to find the connection between the two phases

[25] For description and illustrations of the amphipores in this species see Bull Torr. Bot. Club *32*: 38. 1905.
[26] For cultures of *Puccinia Stipae* see Jour. Mycol. *11*: 63. 1905.
[27] Jour. Mycol. *11*: 11. 1905.
[28] Bot. Gaz. *34*: 12. 1902.

of a heteroecoius rust, during my seven years of experimental work, this is the first instance of success without the aid of some probable clue, and in this case may be ascribed to good luck and the exuberant enthusiasm of Mr. Kern, who made all the sowings of the season.

Teleutosporic material on *Spartina cynosuroides,* collected at Palmer, Neb., by Rev. Bates, was sown May 26, on whatever plants were available in the greenhouse, that are recorded as bearing aecidia of unknown teleutosporic connection. These hosts were: *Polemonium reptans, Polygala Senega, Cassia Chamaecrista, Psoralea Onobrychis, Rudbeckia laciniata, Ambrosia artemisiaefolia, Thalictrum dioicum, Viola papilionacea,* and *Steironema ciliatum.* To our great surprise *S. ciliatum* began to show spermogonia June 1, and abundant aecidia June 6, all others having no infection. Another sowing was at once made, June 2, which likewise gave spermogonia June 7, and aecidia June 12.

The aecidium on this host is recorded or known to the writer from Iowa, Illinois, Nebraska, Kansas, Wyoming and Minnesota. A collection made in Wisconsin [29] on *S. lanceolatum* is thought by Burrill[30] to be specifically distinct. Schlechtendahl's name, *Caeoma Lysimachiae,* sometimes used for American specimens, was founded on an aecidium on *L. thyrsiflora L.* (*Naumburgia thyrsiflora* (L.) Duby) from vicinity of Berlin, and doubtless is entirely distinct from American forms, with the possible exception of the reference in Farlow & Seymour's Host Index,[31] the basis for which is unknown to the writer. Schweinitz's name [32] *Aecidium Lysimachiae* applies to the form on *Lysimachia quadrifolia* and L. *terrestris,* only reported from North Carolina, and may well be considered distinct. What is now much needed is teleutosporic material from the Atlantic and Gulf coasts to be used in cultures for testing the above points, and in general the question whether the eastern and western forms are one species or not.

The great prevalence of this rust on *Spartina,* and the comparative rarity of the aecidia on *Steironema,* is doubtless due in part to the hardiness of the uredospores, which enable them to live over winter and start the uredostage in the spring under favorable conditions. This is the opinion expressed by Mr. Bartholomew in a recent interview, and is my own opinion, founded in part upon finding uredosori upon young blades of *Spartina* only a few inches long at such an early date in spring that infection by means of aecidiospores seemed highly improbable.

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[29] Trelease, Paras. Fung. Wis. p. 30.
[30] Burrill, Paras. Fung. Ill., I. Uredineae, p. 233.
[31] L. c. p.75. 1890.
[32] Schrift. d. nat. Ges. Leipzig *1*: 67. 1822.

SUMMARY.

The following is a complete list of successful cultures made during the season of 1904. It is divided into the two series: species previously reported by the writer or other investigators, and species now reported for the first time.

A. Species previously reported.

1. MELAMPSORA MEDUSAE Thuem. — Teleutospores from *Populus deltoides* Marsh. sown on *Larix laricina* (DuR.) Koch.

2. GYMNOSPORANGIUM JUNIPERI-VIRGINIANAE Schw.—Teleutospores from *Juniperus Virginiana* L. sown on *Malus Malus* (L.) Britt.

3. PUCCINIA SAMBUCI (Schw.) Arth. — Teleutospores from *Carex lupulina* Muhl. sown on *Sambucus Canadensis* L.

4. PUCCINIA ALBIPERIDIA Arth. — Teleutospores from *Carex tetanica* Schk. sown on *Ribes gracile* Michx.

5. PUCCINIA CARICIS-SOLIDAGINIS Arth. — Teleutospores from *Carex sparganioides* Muhl. sown on *Solidago Canadensis* L.

6. PUCCINIA PECKII (DeT.) Kellerm. — Teleutospores from *Carex lanuginosa* Michx. sown on *Onagra biennis* (L.) Scop.

7. PUCCINIA CARICIS (Schum.) Reb. — Teleutospores from *Carex stipata* Muhl. and *C. aquatilis* Wahl. sown on *Urtica gracilis* Ait.

8. PUCCINIA FRAXINATA (Schw) Arth. — Teleutospores from *Spartina cynosuroides* Willd. sown on *Fraxinus lanceolata* Borck.

9. PUCCINIA AMPHIGENA Diet. — Teleutospores from *Calamovilfa longifolia* (Hook.) Hack. sown on *Smilax hispida* Muhl.

10. PUCCINIA VERBENICOLA (E. & K.) Arth. — Teleutospores from *Sporobolus longifolius* (Torr.) Wood, sown on *Verbena urticaefolia* L.

11. PUCCINIA PUSTULATA (Curt.) Arth. — Teleutospores from *Andropogon furcatus* Muhl. sown on *Comandra umbellata* (L.) Nutt.

12. PUCCINIA PAMMELII (Trel.) Arth. — Teleutospores from *Panicum virgatum* L. sown on *Euphorbia corollata* L.

13. PUCCINIA SUBNITENS Diet. — Teleutospores from *Distichlis spicata* (L.) Greene, sown on *Erysimum asperum* DC., *Sophia incisa* (Eng.) Gr., *Lepidium Virginicum* L. and *Bursa Bursa-pastoris* (L.) Britt.

14. PUCCINIA POCULIFORMIS (Jacq.) Wettst. — Teleutospores from *Agrostis alba* L. sown on *Berberis vulgaris* L.

15. PUCCINIA SORGHI Schw.— Teleutospores from *Zea Mays* L. sown on *Oxalis cymosa* Small.; aecidospores from *Oxalis cymosa,* sown on *Zea Mays;* and uredospores from *Zea Mays* sown on same host.

16. PUCCINIA POLYGONI-AMPHIBII Pers. — Teleutospores from *Polygonum emersum* (Michx.) Britt. sown on *Geranium maculatum* L.

17. PUCCINIA HELIANTHI Schw. — Teleutospores from *Helianthus grosse-serratus* Mart. sown on *H. grosse-serratus* Mart. and *H. annuus* L.

18. PUCCINIA LATERIPES B. & Br. — Teleutospores from *Ruellia ciliosa* Pursh, sown on *R. ciliosa* Pursh and *R. strepens* L.

19. PUCCINIA PRUNI-SPINOSAE Pers. — Aecidiospores from *Hepatica acutiloba* D C. sown on *Prunus serotina* Ehrh.

20. PUCCINIA XANTHII Schw. — Resting teleutospores from *Xanthium Canadense* Mill. sown on same host.

B. Species reported now for the first time.

1. PUCCINIA SILPHII Schw. — Resting teleutospores from *Silphium integrifolium* Michx. sown on same host.

2. PUCCINIA GRINDELIAE Pk. — Resting teleutospores from *Gutierrezia Sarothrae* (Pursh) B. & R. sown on same host.

3. PUCCINIA SOLIDAGINIS Pk. — Resting teleutospores from *Solidago trinervata* Greene, sown on *S. Canadensis* L.

4. PUCCINIA TRANSFORMANS E. & E. — Resting teleutospores from *Stenolobium Stans* (L.) Don. sown on same host.

5. PUCCINIA KUHNIAE Schw. — Teleutospores from *Kuhnia eupatorioides* L. sown on same host.

6. PUCCINIA CANALICULATA (Schw.) Lagerh. — Aecidiospores from *Xanthium Canadense* Mill. sown on *Cyperus esculentis* L.

7. PUCCINIA ELEOCHARIDIS Arth. — Teleutospores from *Eleocharis palustris* (L.) R. & S. sown on *Eupatorium perfoliatum* L.

8. PUCCINIA SUBSTERILIS E. & E. — Amphispores from *Stipa viridula* Trin. sown on same host.

9. PUCCINIA SEYMOURIANA Arth. — Teleutospores from *Spartina cynosuroides* Willd. sown on *Cephalanthus occidentalis* L.

10. UROMYCES ACUMINATUS Arth. — Teleutospores from *Spartina cynosuroides* Willd. sown on *Steironema ciliatum* (L.) Raf.

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PEZIZA FUSICARPA GER. AND PEZIZA SEMITOSTA B. & C.

ELIAS J. DURAND.

PEZIZA FUSICARPA Ger. is one of the common discomycetes of the eastern United States. The attractive bowl-shaped ascomata were among my earliest collections in the group, and have been ever since among my favorite objects of observation during the summer months. This continued interest has resulted in the accumulation of a large series of notes which I have been several times on the point of arranging for publication. This has seemed the more desirable because the available descriptions of *P. fusicarpa* and its allied forms are at best incomplete, and certain recent attempts at elaboration have introduced at least as many new elements of confusion as they have dispelled. Mr. Morgan's note on *Peziza pubida* B. & C., in the July number of this Journal has called up the matter once more, and the following contribution is offered in the hope of adding something to our knowledge of the species, and at the same time of clearing up what I believe to be certain misconceptions regarding some of our choicest fungi.

It may not be out of place to state at once that these observations are based on about 50 separate collections, besides numerous ungathered plants in the field. The individuals are occasionally so abundant on the rich sloping banks of ravines near Ithaca, that quarts of them may be gotten in some spots. The herbarium material studied includes the specimens of *P. fusicarpa* collected near Poughkeepsie by Gerard, and sent by him to Cooke to be figured in Mycographia (fig. 113), as well as other specimens from the same locality and collector in the Ellis Herbarium, at the New York Botanical Garden. Inasmuch as no one seems to know the whereabouts of Gerard's own herbarium, or even whether it is longer in existence, these two specimens must be regarded as the most authentic of the species to which access may be had.

Other specimens examined include *P. pubida* B. & C.: the type in Berkeley's herbarium at Kew; *P. semitosta* B. & C.: Berkeley's type at Kew, as well as a duplicate of Dr. Michener's original collection in the herbarium of Elias Fries, at Upsala. What appear to be portions of the types of both the last named species are also present in Massee's herbarium, now at the New York Botanical Garden.

Peziza morgani Mass. is represented by the type in Massee's herbarium as above, as well as by a specimen sent me by Mr. Morgan himself marked "type." Of *P. hainesii* Ell. the type and other examples so named in the Ellis Collection, at New York, have been studied.

My conclusions based upon a study of the material indicated may be stated briefly as follows: *Peziza fusicarpa* Ger. (1873), *P. pubida* B. & C. (1875), and *P. morgani* Mass. (1902) are specifically identical and synonymous; *P. semitosta* B. & C., while closely allied to *P. pubida* B. & C., is not identical with it, but is specificly distinct; *P. hainesii* Ell. (1881) is identical with *P. semitosta* B. & C. (1875), as recently stated by Ellis himself (Jour. Myc. 10: 170).

Whether these species shall be assigned to Lachnea or Macropodia of Saccardo's arrangement may be regarded as a matter of individual opinion. The descriptions indicate the presence or absence of a stem as the primary distinction between the genera. This is surely a most illusive character. *P. fusicarpa* shows great variability in this respect. Often in a single cluster one finds a range from cups absolutely sessile to those with stems of maximum size. An examination of hundreds of growing plants shows that one-half or two-thirds, perhaps, possess some sort of a stem. Lachnea as defined by Saccardo and others is certainly a complex which must be broken up. The name even must be abandoned for a genus of fungi. Macropodia Fckl. was based on a single species *M. macropus* (Pers.) Fckl., which is included by many writers in Helvella, a refernce which seems at least problematical. The excipular structure of the species here considered is quite different from that of most of the species of Lachnea, but corresponds more closely to that of *M. macropus.* The general pliable, leathery texture indicates further relationship with that species. In Macropodia, then, our plants may best be placed until the time when the whole group shall have been thoroughly worked over and revised in accordance with other and perhaps better bases of arrangement.

My ideas of the characters and specific limits of the two species may be gotten from the following descriptions.

MACROPODIA FUSICARPA (Ger.) Durand.

Peziza fusicarpa Ger., Bull Torr. Bot. Club 4: 64. 1873.
Peziza (*Sarcoscyphae*) *pubida* B. & C., Grev. 3: 153. 1875.
Macropodia pubida (B. & C.) Sacc., Syll. 8: 159. 1889.
Lachnea fusicarpa (Ger) Sacc., Syll. 8: 172. 1889.
Peziza velutina B. &. C. (ined.) in Curtis Bot. N. Car. 132. 1867.
Peziza morgani Mass., Journ. Myc. 8: 190. 1902.
Exsicc.: Ellis, N. A. F. n. 1269; E. & E., F. Col. n. 1307.
Illust.: Cooke, Mycog. *figs. 110, 113;* Grev. 3. *pl. 44. f. 226;* Seaver, Bull. Lab. Nat. Hist. Iowa 5, *pl. 20. f. 1.*

Plants solitary or gregarious, often densely so, sessile or stipitate; ascomata at first closed, then expanding until hemispherical-cupulate, the margin slightly incurved, occasionally becoming saucer-shaped; hymenium at first bluish-pallid or creamy-white changing to ochraceous, finally becoming dark brown when old or dry, externally slightly darker, velvety on account of the short bay-brown hairs, which are flexuous, rather thin-walled, obtuse, 1-4 (rarely more) septate, the segments somewhat irregular, about 100-250x20μ (rarely longer); plants variable in size, .5-4 cm. in diam., 1-2.5 cm. deep, fleshy-leathery, pliable, flesh thin; excipulum and hymenium equally thick, the former composed of two distinct layers of equal thickness: the ental one of interwoven hypae, 5μ thick, running more or less parallel to the sides of the cup; the ectal one parenchymatous, cells more or less quadrate, somewhat longer than broad, with rather thick walls, arranged in rows at right angles to the surface, some of the rows being continued outward to form the hairs; stem either entirely absent or up to 1.5 cm. high, .5-1 cm. thick, compressed, often longitudinally sulcate or puckered at the summit, velvety. Asci stout, cylindrical-clavate, apex rounded, not blue with iodine, 260-325x15-18μ; spores 8, obliquely uniseriate or rarely subbiseriate above, hyaline, continuous, fusiform, at maturity distinctly granular roughened, contents granular, 2-guttulate, straight or curved, 32-44x10-11μ (majority 36-41μ). Paraphyses cylindrical, septate, brown, slightly thickened above, 6-8μ thick.

On soil and humus, rarely on very rotten wood, in rich woods and on slopes of ravines, July to Sept. Ontario to Alabama and Iowa.

A common and characteristic, but variable species. The average diameter is about 2 cm., but specimens twice that size are not uncommon. Berkeley and Massee described their plants from dried material in which the hymenium is brown. Gerard, on the other hand, described the hymenium as "at first ochraceous, at length dark brown." The creamy or ochraceous tints are the ones most often seen, but in very fresh young specimens the color is paler resembling that of *Lachnea hemispherica*. As previously stated, about one-half to two-thirds of the ascomata possess some sort of a stem, and all variations may be seen in a single group. The length of the hairs also varies considerably, but those longer than 250 μ are rarely seen. The dried flesh when moistened up is distinctly leathery-gelatinous, but this character is not evident in the fresh state. The young spores are smooth and smaller than mature ones, the latter being distinctly roughened in all the examples I have seen. The shape is distinctly fusiform rather than elliptical-oblong as in the next species. They are very rarely as short as 33μ. In Gerard's collections of *P. fusicarpa* they measure 33-43x10-12μ; in the type

of *P. pubida* 35-40x10μ, while those of the type of *P. morgani* are 35-40x10-11μ. The paraphyses are nearly colorless in young plants, but the contents soon become brownish, finally deep brown throughout — a change coordinate with the change in color of the hymenium from cream-color through ochraceous to brown.

The identity of *P. morgani* with *P. pubida* (as represented in Ellis, N. A. F. n. 1269) was first indicated by Mr. Seaver (l. c.), in 1904. He also later called attention to the fact that the specimen in Rab.-Winter, F. Eur. n. 3275, called *P. pubida* B. & C., is different, being smooth, and having different spores. Mr. Seaver's position is well taken, as I had already satisfied myself by examination of several copies including the one at Kew quoted by Massee. The specimens under that number belong to a species nearly allied to, if not identical with, *Peziza atrovinosa* Cke., the spores being elliptical, 15x8-9μ, rugose roughened, and brown when mature. This latter species is not uncommon in the eastern United States.

Peziza velutina B. & C. was mentioned by Curtis (l. c.), and was said by Cooke to be "undescribed and uncertain." Dr. Peck (Rep. 28:68) declared that according to specimens from Curtis it is the same as *P. fusicarpa* Ger. In the Kew Herbarium the name of the type specimen of *P. pubida* was first written "P. velutina B. & C.," then the "velutina" was lined out and "pubida" written above it. It seems probable, therefore, that Berkeley first thought of naming the species "P. velutina," and reported that name to Curtis (before 1867), but before publication (1875) decided to substitute the name pubida, which he did.

Material examined: Ontario: Hull, J. Macoun; Toronto, J. Dearness.

Connecticut: Redding, F. S. Earle; Mt. Carmel, R. Thaxter.

New York: Poughkeepsie, W. R. Gerard; Ithaca, Durand et al.; Canandaigua, Durand; Honeoye, Durand.

Pennsylvania: Bethlehem, E. A. Rau (Herb. Ellis); West Chester, Everhart and Haines.

West Virginia: Nuttallburg, L. W. Nuttall.

Alabama: Peters.

Ohio: Preston, A. P. Morgan.

Iowa: Decorah, E. W. D. Holway; Iowa City and Mt. Pleasant, F. J. Seaver.

Macropodia semitosta (B. & C.) Sacc., Syll. 8:159. 1889.
Peziza (*Sarcoscyphae*) *semitosta* B. & C., Grev. 3: 153. 1875.
Peziza hainesii Ell., Bull. Torr. Bot. Club 8:65. 1881
Lachnea hainesii (Ell.) Sacc., Syll. 8:186. 1889.
Exsicc.: Ellis, N. A. F. n. 562; E. & E., N. A. F. n. 2740.

Illust.: Cooke, Mycog. *f. 109;* Grev. 3. *pl. 44. f. 225;* Jour. Linn. Soc. Bot. 31. *pl. 16. f. 19.*

Plants sessile or short stipitate, cupulate or urceolate, 2-4 cm. diam.; hymenium creamy-white when fresh becoming brown on drying; cup clothed externally with rufous brown hairs which are obtuse, up to 4-5-septate, scarcely constricted at the septa, rather thin walled, up to 350μ long, rarely longer; stem when present stout, more or less longitudinally plicate and sometimes lacunose below. Asci clavate-cylindrical, apex rounded, 300-325x15μ; spores uniseriate, hyaline, continuous, granular-roughened, elliptical to elliptical-oblong, 25-33x10-12μ (majority 28-32μ); paraphyses cylindrical, apex slightly thickened, septate, brown.

On rich woodland soil, burnt soil, or much decayed wood, Aug.-Oct. Pennsylvania and Delaware.

I have not seen this species in the fresh state and so can give no more information about it than can be gotten from herbarium material. It seems to agree in size, form, color, and certainly in the structure of the excipulum, with *M. fusicarpa,* the chief differences being found in the somewhat longer external hairs, and the shape and size of the spores. The latter are relatively much broader being elliptical or oblong-elliptical with rounded ends, rather than fusiform, and average 28-32μ long as against 36-41μ in *M. fusicarpa.* The largest spores of *M. semitosta* barely surpass the smallest ones of *M. fusicarpa.*

Dr. Michener's collections seem to be somewhat immature, but Mr. Ellis's material seems to be better developed. The spores present agree perfectly in all the specimens. In the type of *M. semitosta* they measure 25-33x10-12μ, while in that of *P. hainesii* they are 30-31x10-12μ.

Material examined: PENNSYLVANIA: Dr. Michener, n. 3936; West Chester, Haines and Jefferies.

DELAWARE: Wilmington, A. Commons.

Botanical Department, Cornell University.

NOTES FROM MYCOLOGICAL LITERATURE XVII.

W. A. KELLERMAN.

SYMBIOSIS IN THE GENUS LOLIUM, E. M. FREEMAN, Minn. Bot. Studies, 3: 329-334, Oct. 18, 1904, admits that it cannot be affirmed without reservation that the entire life-history of L. temulentum is understood, but it can be affirmed that the yearly life-cycle is known, and that the parasite can live on indefinitely,

infecting generation after generation of Lolium plants without spore generation. Professor Freeman also says that the nature of the fungus still remains an open question. "I have previously enumerated the objections to the assignment of this fungus to the ergot-forming parasites and it certainly has little or no resemblances to the Uredineae. Nor has it any similarity to the Hyphomycetes and Pyrenomycetes of molded grains. The Ustilagineae seem to furnish the closest affinities."

Terminology of the spore-structures in the Uredineales, J. C. Arthur, Bot. Gaz. 39: 219-222, March 1905, contains this suggestion relative to proposed designation: "The new terms consist of four words, with their derivatives, one for each of the four stages of uredineal fungi. For the sorus of the initial stage, usually designated by a cipher, and called spermogonium, pycnidium, etc., I propose *pycnium;* derivatives *pycnial, pycniospores,* etc. For the sorus of the first spore-stage, usually designated by the Roman numeral I, and called aecidium, roestelia, peridermium, etc., I propose *aecium:* derivatives *aecial, aeciospore,* etc. For the sorus of the second spore-stage, usually designated by the Roman numeral II, and called uredosorus, etc., I propose *uredinium* (uredo); derivatives *uredinial, urediniospore* or if preferred *uredospore,* etc. For the sorus of the third spore-stage, usually designated by the Roman numeral III, and called teleutosorus, I propose *telium;* derivatives *telial, teliospores,* etc."

The common Ithphallus impudicus, generally considered to be a saprophyte only, has been found to be the cause of a destructive root rot of the vine in Hungary. According to the account given by Istvanffi (Ann. Inst. Cent. Ampelologique Roy. Hongrois 3: 1-55, 1904) the subterranean part of the stem is entwined by a network of the characteristic cord-like strands of mycelium of this fungus. From these, branches are sent into the interior of the stem. Small roots are totally destroyed by strands which penetrate them lengthwise, destroying all the tissues and leaving only the thin decaying cortex. In the older roots the cortex and phloem are totally destroyed, leaving only a mass of debris. The wood cylinder is last attacked, but this also is finally destroyed, leaving only scattered remnants of the vessels. [H. Hasselbring in Botanical Gazette.]

Sexual Reproduction in the Rusts by A. H. Christman, Botanical Gazette, April 1905, can not be sufficiently indicated in a word but possibly the following quotation may show the trend of the article: "Maire's conception that the nuclear fusion in the teleutospore is a *mixis,* was developed on the basis of the belief that no real cell fusion occurs in the life cycle of the rusts. It is at least a fair presumption that while no nuclear fusion occurs in the aecidium, the fusion of gamete cells described

above presents all the essential features of sexual conjugations as found in other plants and animals. Superficially considered, Raciborski's conception that the sexual union may be regarded as consisting of two phases, cell fusion and nuclear fusion, might seem to fit the conditions found in the rusts. I am inclined, however, to accept Blackman's conclusion that the fusion in the teleutospore has wholly to do with the reduction of the number of chromosomes."

Otto Jaap, Fungi Selecti Exsiccati, Serie 4, Ausgegeben im Oktober 1904, contains: (76) Taphridium umbelliferarum f. peucedani, (77) Taphria coerulescens, (78) Exoascus alni incanae, (79) Mycosphaerella salicicola f. amygdalinae, (80) Ophiognomonia padi Jaap n. sp. on Prunus padus, (81) Diaporthe valida, (82) Aporia Jaapii Rehm n. sp. on Aspidium squamulosum, (83) Naevia Rehmii Jaap n. sp. on Juncus anceps, (84) Briardia purpurascens, (85) Lachnum arundinis, (86) Desmazierella acicola, (87) Mitrula pusilla, (88) Urocystis Fischeri, (89) Setchellia punctiformis, (90) Melampsora amygdalinae, (91) Uromyces ranunculi-festucae, (92) Uromyces scirpi f. hippuridis-scirpi, (93) Uromyces scirpi f. glaucis-scirpi, (94) Puccinia angelicae-bistortae, (95) Rostrupia clymi, (96) Cyphella gregaria, (97) Polyporus brumalis, (98) Diplodina obionis Jaap n. sp. on Obione portulacoides, (99) Ovularia vossiana, (100) Didymaria linariae; and Supplement: 1. Magnusiella potentillae, 2. Nectria episphaeria, 3. Septoria nigerrima.

The effect of different Soils on the Development of the Carnation Rust is discussed by John L. Sheldon of the West Virginia Agricultural Experiment Station, see Bot. Gaz. Sept. 1905. The experiments reported and conclusions drawn are interesting, but since they are of little or no taxonomic significance they must be passed without further comment — with the remark, however, that he found that the soils favorable for the host were also favorable for the Rust.

Roland Thaxter, A New American species of Wynnea, Botanical Gazette, April 1905. It was found by the author in 1888, in Tennessee, growing on the ground in rich woods, in a single locality, where several clusters of its long bluntly pointed, rabbit-ear-shaped, dark brown apothecia were scattered in a limited space, each cluster borne on a well defined stout stem, emerging directly from the humus. The same thing was collected also in Ohio. Dr. Thaxter named the species Wynnea americana, illustrating the same by two plates — one showing the plant natural size and the other showing asci, spores and other details.

Minnesota Helvellineae, Daisy S. Hone, Minnesota Botanical Studies, 3: 309-321, Pl. XLVIII-LII, Oct. 18, 1904, is a list of 14 species, with newly written descriptions, all splendidly illustrated on heliotype plates.

Observations on Physalacria inflata (Schw.) Peck, by Jessie M. Polley, Minnesota Botanical Studies, 3:323-8, Pl. LIII, Oct. 18, 1904, treats of the rare and interesting fungus that was named Leotia inflata by Schweinitz in 1822. A new study of the plant from material collected at Detroit, Minnesota was made by Miss Polley.

J. C. Arthur in Leguminous Rusts from Mexico (collected by E. W. D. Holway), published in the June No. of the Botanical Gazette, 1905, enumerates 37 species. Of these the following are new species: Uromyces rugosa, U. montanus, U. cologaniae, U. clitoriae, U. bauhiniicola, Calliospora holwayi, C. farlowii, C. diphysae, Uredo aeschynomenis, Revenelia lysilomae, R. gracilis, R. pithecolobii, R. inconspicua, and R. pulcherrima. A new genus of Rusts,namely, Calliospora is proposed, with the following diagnosis: Teleutosori arising from beneath the epidermis, soon naked; teleutospores 2-celled by transverse partition, wall colored, with an external layer which swells in water; germ pores 2 in each cell, lateral. Aecidium and uredo wanting. Spermogonia arising from beneath the cuticle, conical.

Contributions to the Biology of Rhizobia, IV: two coast Rhizobia of Vancouver Island, B. C., by Albert Schneider is published in the Botanical Gazette for August 1905, and relates to forms found in the beach vetch, Lathyrus maritimus Bigel., and the beach clover, Trifolium heterodon Gray.

The V. Contribution to the Biology of Rhizobia by Albert Schneider, published in the Botanical Gazette for October 1905, deals with the isolation and cultivation of Rhizobia in artificial media.

Rusts on Compositae from Mexico is an important contribution to the mycology of that region, by J. C. Arthur in the Botanical Gazette for September 1905. They are mostly the collections of Prof. E. W. D. Holway, the list containing 54 species. The new species described are Coleosporium dahliae, C. steviae, Dietelia eupatorii, D. vernoniae, Uromyces senecionicola, Puccinia senecionicola, P. globulifera, P. gymnolomiae, P. caleae, P. axinophylli, P. noccae, P. jaliscana, P. diaziana, P. semi-insculpta, P. egregia, P. zaluzaniae, P. concinna, and P. paupercula.

Fertilization in the Saprolegniales, by B. M. Davis, in the Botanical Gazette, January, 1905, is mainly a critical discussion of Trow's reaffirmed conviction that a sexual act is present in the water molds, etc.; with then the remark that much more work must be done both on the Saprolegniales and Peronosporales before some of the points suggested by Trow's paper will be established.

THE POLYPORACEAE OF NORTH AMERICA — XII. A synopsis of the white and bright-colored species. Bulletin of the Torrey Botanical Club, 32:469-493, September 1902. "The classification here adopted is acknowledged to be imperfect and artificial, but it is hoped that it will lead to something better when our knowledge of the plants treated is more complete." Synopses are given as in previous installments and the treatment is similar in other respects. The new genera proposed are: Ircipiporus (type Irpex mollis B. & C.); Dendrophagus (type Polyporus colossus Fr.); Rigidiporus (type Polyporus micromegas Mont.); Earliella (type Earliella cubensis Murrill n. sp.); Cubamyces (type Polyporus cubensis Mont.); Coriolellus (type Trametes sepium Berk.); Microporellus (type Polyporus dealbatus B. & C.); Flaviporellus (type Polyporus splitgerberi Mont.); Aurantiporus (type polyporus alboluteus E. & E.); Aurantiporus (type Polyporus pilotae Schw.); Pycnoporellus (type Polyporus fibrillosus Karst.); and Phaeolopsis (type Polyporus verae-crucis Berk.).

FREDERICK LEROY SARGENT'S ARTICLE LICHENOLOGY FOR BEGINNERS III, published in the Bryologist, Sept. 1905, is illustrated by numerous figures; some of the subjects fully discussed are the chief forms of the thallus, the principal forms of apothecia, and the spores.

WHAT TO NOTE IN THE MACROSCOPIC STUDY OF LICHENS II, by Bruce Fink, published in the Bryologist, September 1905, is treated under the following subheads: Variation in Lichens, the Apothecium, the Disk, the Exciple, Position of the Apothecia, Stipes and Podetia, Rhizoids and Cilia, Some other structures and Conclusion.

A NOTE REGARDING THE DISCHARGE OF SPORES OF PLEUROTUS OSTREATUS, by C. C. Harmer, is given in the Torreya for August 1905. He says that a large plant left in the room one night, exposed to strong morning sunlight caused the spores to arise from the plant like tiny spirals of smoke or steam, to the height of two or three feet, making a very strange sight.

THE GENUS CORTINARIUSS A PRELIMINARY STUDY, by Calvin Henry Kauffman, in the Bulletin of the Torrey Botanical Club, June, 1905, is a partial monograph based on thorough study extending through a period of three years. A key is given for the Cortinarii in the vicinity of Ithaca. The subheads of the article are as follows: Introduction, Historical, General considerations, Generic description, Key to Subgenera, Structure of the pileus and stem, Gills, Spores, Habitat, Identification, and Species. Under the latter a key is given and seven new species described.

A NEW POLYPOROID GENUS FROM SOUTH AMERICA (called PHYLLOPORIA) by William A. Murrill, is noted in Torreya for

September 1904. It is the only species known which occurs parasitic on leaves. Looked at from above, the author says in speaking of the leaves, the host appears to be attacked by a leaf-parasite and it is quite surprising to find on the lower surface the sporophores of one of the Polyporaceae. The pileus is 5-8 mm. in diameter and 0.2-1 mm, thick.

Tycho Vestergren, Monographia der auf der Leguminosen-gattung Bauhinia vorkommenden Uromyces-Arten, in Arkif foer Botanik, K. Svenska Vetenskaps-akademien I Stockholm, Band 4, No. 15, is an important monograph, the subheads being Morphologische Uebersicht, Verwandtschaftsverhaeltnisse, Uebersicht der Species and Diagnosen der species. The spores of 17 species included in the paper, each fully described, are illustrated on two lithographic plates. Eleven of the species are new. Most of the species are from South America (one only occurs in Europe) but a few also have been found in Mexico and the West Indies.

A new Genus of Ascomycetous Fungi by Nathaniel Llyon Gardner forms vol. 2, No. 6, pp. 169-18, pl. 18, University of California publications, Botany, issued July 27, 1905. It is based on Sphaeria (Hypocrea) setchellii Hark., a species that was published some years ago. The generic name proposed is Nigrosphaeria; its scant mycelium penetrates the subhymenial tissues of the host — in the case investigated this being the saprohytic Pseudhydnotria Harknessii, which grows in sandy soil. Both host and parasite are ascomycetous fungi.

The Polyporaceae of North America — X. Agaricus, Lenzites, Cerrena and Favolus, by William Alphonso Murrill, Bulletin of the Torrey Botanical Club, 32: 83-103, February 1905, treats of plants with variable daedaleoid or lamelloid hymenium and light-colored context and spores. The author says they recognize none of the ordinary specific or even generic limitations of the group and that if they are amenable to ordinary methods of cultivation, they would surpass *Oenothera* in supplying most excellent examples of mutation. The treatment of the subject is similar to that in previous installments and needs no further elucidation. It might be remarked that it is not altogether unappalling to some botanists to see the name Agaricus transferred to our common Daedalea quercina — and whether Mr. Murrill's nomenclature and many new genera of the Polyporaceae will be accepted by the older workers remains to be seen.

Organisms on the Surface of Grain with special reference to Bacillus coli, by Haven Metcalf, Science, N. S., 22: 439-441, 6 Oct. 1905, is a preliminary note on work done in the Piedmont region and the Rice-belt of South Carolina, in 1903-4. Some of the conclusions are as follows: An immense but

variable number and variety of micro-organisms were normally present on the surface of flowers, fruits and leaves. These were different in different localities, and different in successive years in the same locality, and showed no constant association with the host plants studied. . . . The most constantly present organisms were certain yeasts; in greatest number and variety on the peach, asparagus and iris; bue yet characteristically present on the cereals. . . . Bacteria giving the standard reactions of the colon group were found in thirteen out of sixteen rice fields examined, five of the eight wheat fields and all of the oat fields. All three peach orchards and both asparagus patches exhibited coli forms in both flower and fruit; but none were found on either flower or fruit of *Iris verna.*

A PRELIMINARY NOTE ON CLOVER DISEASES IN TENNESSEE by Samuel M. Bain and Samuel H. Essary, Science, N. S., *22*: 503, October 20, 1905, refers to the prevalence, greater or less, of *Uromyces trifolii, Pseudopeziza trifolii,* and *Macrosporium sarcinaeforme* but the author says: The most destructive disease thus far found is what appears to be an undescribed species of COLLETOTRICHUM. In its general appearance this disease very closely simulates the anthracnose of clover (*Stengelbrenner*), described by Mehner and Kirchner and by the latter attributed to the attacks of *Gloeosporium caulivorum* n. sp.

TWO CONIDIA-BEARING FUNGI, CUNNINGHAMELLA AND THAMNOCEPHALIS N. GEN., by A. F. Blakeslee, (with plate), is the first article in the September No. of the Botanical Gazette, 1905. The first species discussed is C. echinulata Thaxter, seldom reported, and the second is Thamnocephalis quadrupedata, growing in a gross dung cluture on fresh sphagum. The new genus is characterized as follows: Thamnocephalis. — Vegetative hyphae fine, continuous, anastomosing. Fructifications erect, consisting of a main stalk supported above the substratum by stout rhizoidal props and bearing a bushy crown of subdichotomously branched fertile hyphae terminated by sterile branches. Spores solitary, borne on the surface of spherical heads. Heads borne at the apex of short lateral stalks which arise at nodes from opposite sides of the fertile hyphae at right angles to their planes of branching.

CHROOLEPUS AUREUS A LICHEN, is what Albert Schneider maintains in the August (1905) No. of the Bulletin of the Torrey Botanical Club. Material collected at Vancouver Island presented opportunity for the study, and here is his conclusion: There seems to be little doubt that the network described represents a fungus symbiotically associated with the alga *Chroolepus aureus.* This association appears to be sufficiently constant to warrant placing this structure, heretofore classed as an alga, with the class *Lichenes.* The fungal symbiont does not appear to develop

spores or any other special structures found with the fungal symbionts of the majority of lichens.

Annales Mycologici, vol. III, No. 3, June, 1905, contains: Bubák, Fr., Beitrag zur Kenntniss einiger Uredineen; Rehm, Ascomycetes exs. Fasc. 34; Sydow, Mycotheca germanica Fasc. VII (No. 301-350); Rick, J., Pilze aus Rio grande do Sul; Salmon, Ernest S., The Erysiphaceae of Japan, II; Lederer, Michael, Die Flechtenflora der Umgebung von Amberg; Neue Literatur; Referate und kritische Besprechungen.

Annales Mycologici, vol. III, No. 4., Aug. 1905, contains the following: McAlpine, D., A new genus of Uredineae — Uromycladium; Höhnel, Franz v., Mycologische Fragmente; Vueillemin, P., Identité des génres Meria et Hartigiella; Guilliermond, A., Remarques sur la Karyokinése des Ascomycétes; Cavara, Fr., Causeries mycologiques; Neue Literatur; Referate und kritische Besprechungen.

Hedwigia, Band XLIV, Heft 6, 25 Aug. 1905, has for mycologists the four articles: P. Dietel, Uber die Arten der Gattung Phragmidium II; P. Magnus, Uber die Gattung, zu der Rhizopodium Dicksonii Wright gehört; Fr. Bubàk und J. E. Kabat, Mykologische Beiträge III; P. Magnus, Zwei parasitische Harpographium-Arten und der Zusammenhang einiger Stilbeen mit Ovularia oder Ramularia.

Hedwigia, Band XLIV, Heft 2, 31 Jan. 1905, has the following mycological papers: P. Hennings, Fungi amazonici IV, a cl. Ernesto Ule collecti; Zoltan von Szabo, Uber eine neue Hyphomyceten-Gattung; P. Dietel, Uber die Arten der Gattung Phragmidium (Anfang).

Hedwigia, Band XLIV, Heft 3, 13 Mar. 1905, contains mycological articles, for example: P. Dietel, Uber die Arten der Gattung Phragmidium (Schluss); Jos. Stefan, Beitrag zur Kenntniss von Collybia racemosa Pers.; P. Hennings, Einige schädliche parasitische Pilze auf exotischen Orchideen unserer Gewächshäuser.

The Report of the Botanist of the Connecticut Agricultural Experiment Station for the year 1904, part IV, pp. 311-384, pl. XVIII-XXXVII, issued May 1905, is a discussion by G. P. Clinton under three heads as follows (1) Notes on Fungous Diseases, etc., for 1904; (2) Downy Mildew or Blight, Peronoplasmopora cubensis (B. & C.) Clint.; (3) Downy Mildew, or Blight, Phytophthora infestans (Mont.) DeBy. of Potato. Attention is called especially to the two last articles which are exhaustive. Dr. Clinton takes up the history, systematic classification, life cycle, spraying experiments and conclusions; also for the Melon blight a bibliographical list of all the more important articles on the subject.

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EDITOR'S NOTES.

The matter of concise and uniform citation in connection with publication of scientific matter is an affair of such importance and as such so universally recognized that no comment further need be made here; yet do not Periodicals have a duty to perform in the way of facilitating this matter? Are not one or two scientific magazines yet direlict?

These items should invariably be given as a running head line, in addition to page number; on the left page the *Name of the Journal,* and the *Volume Number;* on the right, the *date* (immediately opposite and adjacent to the vol. no.), and the *Topic of the article* (the author's name may be prefixed if desired). If it is a New Series, or Second or Third Series, etc., the *proper abbreviations* should be prefixed to the Volume No. The *Serial No. of the issue* should not be given in the running head lines.

Every periodical should (and practically all do) have a cover. This is very convenient for very mnay purposes — and one of these is the *conspicuous display* of the *Serial No.* of the issue. It is a convenience to the librarian who keeps periodicals in order for patrons, and no less to the person consulting the file. But no reference to the *No.* should be included in an *ordinary citation of literature.* The volume and page are ordinarily sufficient but the date is sometimes advantageous in looking up a reference, though the less the searcher has to hold in mind while hunting the better. We repeat: The *Serial No.* should *not* be given *on any page* of a scientific publication, but should be conspicuous on the cover, the latter to be discarded when the Nos. are bound into a volume.

Professor Schaffner has kindly seen this No. through the press during the absence of the editor.